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TELESCOPING GRAIN TRANSPORT APPARATUS FOR COMBINE OR THE LIKE

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[There are no amendments to this patent.]

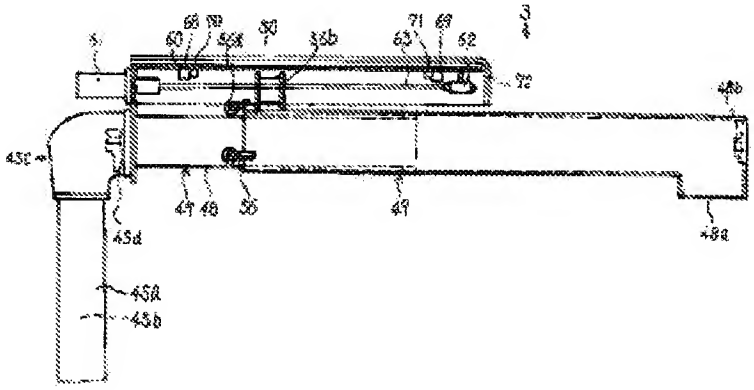
Abstract

Problem

To prevent damage to the retraction-side sensor and extension-side sensor that stop the movement of a moving transport tube.

Means to solve

Cushioning members (70) and (71) that cushion contact impact are provided to the near side of a retraction-side sensor (68) and an extension-side sensor (69) that, in order to stop said moving transport tube (49), sense the final retraction position and the final extension position by means of contact with moving metal (56b) of moving apparatus (50) that moves a moving transport tube (49) inserted to be able to move along the outer circumference of a fixed transport tube (47),



Claim

1. In a combine or the like furnished with a fixed transport tube (47), inside of which is mounted a moving auger (51) to which grain is fed and by which it is transported, and a moving apparatus (50) that moves a moving transport tube (49), wherein said moving transport tube (49) has mounted inside it multiple moving transport augers (55b) that overlap to be able to telescope, and is inserted over the outer circumference (48) of said fixed transport tube (47), a telescoping grain transport apparatus for a combine or the like characterized in that cushioning members (70) and (71) are furnished to cushion impact when moving metal (56b) contacts a retraction-side sensor (68) and an extension-side sensor (69), respectively, that sense the final position in the retraction direction and the final position in the extension direction in order to stop said moving transport tube (49) due to contact with moving metal (56b) of said moving apparatus (50).

Detailed explanation of the invention

[0001]

Technical field of the invention

This invention relates to a telescoping grain transport apparatus furnished with cushioning members, mounted on the near side in the direction of movement, that cushion the moving metal contact impact with a retraction-side sensor and an extension-side sensor that sense the final position in the retraction direction and the final position in the extension direction in order to stop a moving transport tube due to the contact of the moving metal of a transport apparatus that moves a moving transport tube furnished inserted around the outer circumference of a fixed transport tube that transports grain, and that can be used for a discharge apparatus that delivers grain in a combine or the like to outside the equipment..

[0002]

Prior art

For example, when harvesting with a combine, cut grain stalks cut with the reaper of a combine are fed to a thresher and threshed. The grains that have been threshed and separated are supplied to a temporary grain storage tank and stored. The stored grain is discharged outside the machine with a telescoping grain transport apparatus, and when the discharge position during discharge is far from the combine, a freely movable transport tube of the telescoping grain transport apparatus is extended from a fixed transport tube by a moving apparatus, and when it extends to a specified position, the moving metal of said moving apparatus contacts an extension-side sensor, and extension of said moving transport tube stops due to the contact.

[0003]

When extension stops, grain is transported inside the fixed transport tube with transport augers mounted in the aforementioned fixed transport tube, it is transferred by the individual moving transport augers, and it is transported inside said moving transport tube and discharged outside the equipment by each of the moving transport augers.

[0004]

Problem to be solved by the invention

When the moving transport tube is moved, moving metal of the moving apparatus sometimes forcefully contacts the retraction-side sensor and the extension-side sensor in the final position in the retraction direction and final position in the extension direction of the moving transport tube, and damage to the retraction-side sensor and extension-side sensor occurs because of this. This problem will be solved with this invention.

[0005]

Means to solve the problem

For this purpose, this invention constitutes a telescoping grain transport apparatus for a combine or the like which is characterized in that, in a combine or the like furnished with a fixed transport tube (47), inside of which is mounted a moving auger (51) to which grain is fed and by which it is transported, and a moving apparatus (50) that moves said moving transport tube (49), wherein said moving transport tube (49) has mounted multiple moving transport augers (55b) that overlap to be able to telescope, and is inserted over the outer circumference (48) of said fixed transport tube (47), cushioning members (70) and (71) are furnished to cushion impact when moving metal (56b) contacts a retraction-side sensor (68) and an extension-side sensor (69), respectively, that sense the final position in the retraction direction and the final position in the extension direction in order to stop said moving transport tube (49) due to contact with moving metal (56b) of said moving apparatus (50).

[0006]

Operation of the invention

During harvesting with a combine, cut grain stalks cut with the reaper of the combine are fed to a thresher and threshed. Grain that has been threshed and separated is fed to a temporary grain storage tank and stored, and the stored grain is discharged outside the equipment with a telescoping grain transport apparatus. When the discharge position is far from the combine when discharging, moving transport tube (49), which is freely movable, of the telescoping grain transport apparatus is extended from fixed transport tube (47) by moving apparatus (50). When it extended to a specified position, moving metal (56b) of said moving apparatus (50) contacts extension-side sensor (69) via cushioning member (71), and the extension of said moving transport tube (49) stops due to this contact.

[0007]

When extension stops, grain is transported inside fixed transport tube (47) by transport auger (51) mounted in the aforementioned fixed transport tube (47), it is transferred by individual moving transport augers (55b), and is transported inside of said moving transport tube (49) and discharged outside the equipment by individual moving transport augers (55b).

[0008]

Effects of the invention

Moving metal (56b) of moving apparatus (50) that moves moving transport tube (49), by contacting retraction-side sensor (68) and extension-side sensor (69) via their respective cushion members (70) and (71) furnished on the near side in the direction of transport, of retraction-side sensor (68) and extension-side sensor (69) that sense the final positions in the retraction and the extension directions where moving transport tube (49) is stopped, can cushion the impact at the time of contact, and thus damage to retraction-side sensor (68) and extension-side sensor (69) can be prevented.

[0009]

Embodiment of the invention

Below, an embodiment of the present invention will be explained based on figures. A telescoping grain transport apparatus (3) furnished at the top of a grain storage tank (8) and that discharges grain stored in grain storage tank (8) mounted in a thresher (2) installed in a combine (1) is explained with reference to illustrations.

[0010]

A travel apparatus (6) on which a pair of left and right travel crawlers (5) is stretched to travel over the soil surface, is furnished on the lower part of chassis (4) of said combine (1). A thresher (2) that threshes cut grain stalks and held transported in a feed chain (7) and that separates and recovers the threshed grain, and in which is mounted a temporary grain storage tank (8) to the side is installed at the top of said chassis (4). At the front of said thresher (2), a reaper (13) furnished with a grass divider (9) that divides upright grain stalk from the front end position, a raising apparatus (10) that raises the divided grain stalks, a cutting blade that mows the raised grain stalks, and a grain stalk raking and transport apparatus (12) that transports the cut grain stalks and passes them to feed chain (7), is constituted to be operated raised or lowered relative to the soil surface with a telescoping hydraulic drive cylinder (14).

[0011]

On the aforementioned thresher (2) side, an operating unit (15) that controls operation of combine (1) and a driver seat (16) where an operator rides are furnished. An engine (17) is mounted below driver seat (16), and a grain storage tank (8) is installed at the back. The body (18) of said combine (1) is constituted by travel apparatus (6), said thresher (2), reaper (13), and said engine (17).

[0012]

In the grain stalk transport path formed by grain stalk raking and transport apparatus (12) of said reaper (13), a grain stalk sensor (19) is furnished that senses whether or not stalks are fed to thresher (2) by contact with the grain stalks that are cut and transported. A wheel speed sensor (21) that senses the running wheel speed based on the output rotational speed is furnished in the transmission path of travel mission [sic; transmission] (20) mounted at the front end of chassis (4).

[0013]

Said thresher (2) is constituted with a threshing chamber (22), a dust processing chamber (23), a tailings processing chamber (23) furnished at the upper part as shown in Figure 19, and a separating chamber (25) disposed at the lower part. Inside said threshing chamber (22), a threshing drum (26) in which many various kinds of threshing teeth (26a) are provided to thresh the cut grain stalks is mounted on a front to aft shaft. Inside tailings processing chamber (24), positioned toward the front and parallel to the right side of said threshing chamber (22) in plan view, a tailings processing drum (28) in which are mounted a tailings transport auger (27a), many processing teeth (27b), and a second discharge vane (27c), in that order from the transport front end that process the unthreshed processed material (tailings) that is circulated while being transported to the front and discharged to separating chamber (25), and are mounted on one shaft, and mounted on that same shaft inside of dust processing chamber (23a) positioned toward the back are a dust processing drum (30) a dust transport auger (29a), many processing teeth (29b) and a dust discharge vane (29c), in that order from the transport start end, that reprocess part of the unthreshed processed material fed from said threshing chamber (22) while transporting it to the back, are mounted on the same shaft.

[0014]

Feed chain (7) that holds cut grain stalks and a gripping post (31) are furnished along threshing opening (26b), to the left, in plan view of said threshing chamber (22), and a threshing mesh (26c) surrounding the space from the lower part of the peripheral edge of threshing teeth (26a) to threshing drum cover (32), leak-down fixture (33), furnished with rod-like members at specified intervals, and tailings receiving mesh (34) are furnished toward the back enclosing the lower part of the outer peripheral edges of processing teeth (27b) and (29b) furnished with steps. Toward the transport termination part of said leak-down fixture (33) is furnished a dust discharge opening (33a) that discharges chaff processed inside said dust processing chamber (23) and dust such as from cut stalks. A tailings outlet (34a) is furnished toward the transport termination part of said tailings receiving mesh (34) that discharges part of the processed material that has been threshed inside tailings processing chamber (24).

[0015]

Inside said separating chamber (25) is furnished in the direction of the axis of threshing drum (26) a shaking separating apparatus (35) that is fed threshed material that has leaked down from threshing teeth (26c), processed material leaked down from leak-down fixture (33) and tailings receiving mesh (34), processed material discharged from tailings outlet (34a), and dust discharged from dust discharge opening (33a), and this shakes for the purpose of separating while transporting. Shaking separating apparatus (35) is furnished with a transfer shelf (36a), a chaff sieve (36b) and a straw rack (36c), in that order from the front. At the lower part of said chaff sieve (36b), a grain sieve (36d) is furnished, said chaff sieve (36b) is constituted such that the transport angle can be adjusted, and is constituted so that the amount passed down can be adjusted.

[0016]

At the lower part toward the starting end, in the transport direction (toward the top) of said shaking separating apparatus (35), a blower (37) is furnished inside of which is rotatably mounted a blower blade (37a). The separating air flow created by blower (37) is constituted to blow apart the grain and the dust. (37b) is an air flow divider. The forward end toward the bottom side of said blower (37) is connected with the top side of primary receiving chute (39b) that houses grain separated downstream from primary separating rack (38) and feeds it laterally with primary auger (39a), and the bottom side is connected with the lower end of said primary separating rack (38). At the bottom near the upper end of primary separating rack (38), the upper end on the top side of tailings receiving chute (41b) that houses unthreshed processed material (tailings) that is separated downstream from tailings separating rack (40) and sends it laterally with tailings auger (41a) is positioned overlapping at an appropriate spacing, and the upper end of tailings separating rack (40) is open to the outside of the equipment.

[0017]

Grain sent laterally by aforementioned primary auger (39a) is transferred by a grain lifting apparatus (not shown), and is stored by being lifted into grain storage tank (8). A tailings circulation tube (42a), inside of which is mounted a lifting auger (42b) that transfers unthreshed processed material (tailings) sent laterally by aforementioned tailings auger (41a) to lift it into tailings processing chamber (24), is furnished on a slant to the right side, in plan view, of thresher (2).

[0018]

Furnished toward the top at the transport termination part of said shaking separating apparatus (35) is a dust fan (43) that discharges the separating air flow from blower (37) along with the separated dust produced by said shaking in shaking separating apparatus (35). Furnished at the bottom inside said grain storage tank (8) is a lateral transport auger (8a) that sends stored grain laterally toward the back, and in addition, a grain discharge support tube (45a) that transfers the grain sent laterally, and inside of which is mounted a longitudinal transport auger to change direction through a joint case (44), is furnished to be able to rotate in a vertical orientation supported on the back of said grain storage tank (8) at the top of said joint case (44). A telescoping grain transport apparatus (3), the entire length of which moves forward and backward across the front to back length of combine (1) with joint case (45c) furnished at the upper end of grain discharge support tube (45a), and that moves up and down, is furnished to discharge grain.

[0019]

Said telescoping grain transport apparatus, as shown in Figures 1-15, is constituted with a fixed transport tube (47) mounted on joint metal (46), a moving transport tube (49) that telescopes freely and is inserted around the outer circumference (48) of fixed transport tube (47), and a moving apparatus (50) that moves moving transport tube (49). At the transport termination part of said fixed transport tube (47), as shown in Figure 4, a fixed auger shaft (52) with a transport auger (51) mounted on the outer circumference is mounted. On the inner diameter of fixed auger shaft (52), a hexagonal or round insertion hole (52a) is furnished, and an auxiliary shaft (53) provided with a hexagonal insertion hole smaller than said insertion hole (52a) is fitted in the inner diameter at the transport termination of fixed auger shaft (52).

[0020]

The outer diameter of the transport termination part of said fixed transport tube (47) is axially supported inserted into the inner diameter of an outer circumferential boss (46b) of joint metal (46), and the outer diameter of auxiliary shaft (53) is axially supported inserted into the inner diameter of a bearing (46a) furnished in the inner diameter of inner circumferential boss (46c) of joint metal (46). The transport start part of fixed auger shaft (52) is constituted axially supported by metal bearing (45d) furnished inside joint case (45c).

[0021]

Outer circumferential boss (46b) of said joint metal (46) is in circular form, and is configured such that the inner circumference of moving transport tube (49a) moves by sliding on the outer circumference of the circular form. Said joint metal (46), as shown in Figures 5 and 6, is

constituted such that outer circumferential boss (46b) and inner circumferential boss (46c) are connected with a connecting arm (46d). Joined part (A) of the lower part of connecting arm (46d) and the outer diameter of inner circumferential boss (46c) are anchored using welding or the like. The upper part of connecting arm (46d) is inserted into the hole of said outer circumferential boss (46b), and the joined part (B) of the upper part of connecting arm (46d) and the hole of said outer circumferential boss (46b) are anchored using welding or the like, so that there is no resistance to the grain passing through joint metal (46).

[0022]

Said joint metal (46), as shown in Figures 5 and 6, has multiple, for example, 3, seals (46e) made of an elastic member mounted on the outer diameter of outer circumferential boss (46b) of joint metal (46), and is constituted such that dust moves from locations to which no seal (46e) is mounted, the dust in fixed transport tube (47) is discharged outside the equipment through the inside of moving transport tube (49), and movement of moving transport tube (49) is accomplished smoothly. A reinforcing tube (49a) is anchored at the transport termination of said moving transport tube (49), as shown in Figure 7, and the lower part at the transport termination part of reinforcing tube (49a) forms a downward triangular projection (49b) making discharge of dust, etc. out of the equipment smooth.

[0023]

Said joint metal (46), as shown in Figure 20, could also be constituted such that a link (46f) made of metal material with a circular cross section is mounted at both the front and back ends of outer circumferential boss (46b) of joint metal (46). Dust and wear resistance are both improved. Because the total length of said moving transport tube (49) is great, joining is required. In this case, as shown in Figures 8 and 9, the constitution is separable into 2 or 3 parts. The figures show separation into 2 parts. For joining the separated parts, as shown in Figures 10-(a)-(10)-(c), a fastening pin (49d) is inserted into joint link (49c). A snap spring (49e) is furnished at one end of fastening pin (49d), and a tightening cam (49f) in which a lever is integrally anchored to the cam is mounted with a support pin (49h) at the shaft end at the other side. Joint link (49c) produces a fastening action by the turning of fastening cam (49f) to join moving transport tube (49) and (49), joining of the separated moving transport tubes (49) and (49) is easy, and they can be joined quickly.

[0024]

In said moving transport tube (49), moving transport augers (55a) and (55c) are inserted to be axially supported at both ends of hexagonal moving auger shaft (54), and multiple moving

transport augers (55b) are inserted to be axially supported between moving transport augers (55a) and (55c), and they are mounted inside along with moving auger shaft (54). The transport termination part of said moving transport tube (49) is formed into an L shape. A discharge opening (48a) is furnished at the transport termination. At the upper part of discharge opening (48a), metal bearing (48b), that serves as a "bearing" for the transport termination part of moving auger shaft (54), is furnished and movably held. And as shown in Figure 4, the inner diameter of the transport termination of auger internal boss (57a) of moving transport auger (55a) is inserted and movably held on the outer diameter of auxiliary shaft (53) furnished at the transport termination of fixed auger shaft (52), mounted with a bolt (53b). Said moving auger shaft (54) moves front-to-back inside auxiliary shaft (53) and said auger internal boss (57a).

[0025]

At the upper part on the outer circumference of said moving transport tube (49), moving metal (56b) is furnished provided with a screw hole in the center. At three locations on the outer circumference, an axially supported roller (56a) that can rotate with a support plate (56) is furnished, and each roller (56a) moves by rotating forward and backward along the outer circumference of fixed transport tube (47). At three locations on the inner circumference at the transport termination part of said moving transport tube (49), as shown in Figure 1, a roller (56d), axially supported to be able to rotate, could be furnished with a support plate (56c), and each roller (56d) could move by rotating forward and backward along the outer circumference (48) of fixed transport tube (47). Movement of said moving transport tube (49) is made smooth in this way.

[0026]

Because the total length of moving auger shaft (54), in which each of said moving transport augers (55a), (55b) and (55c) are inserted and axially supported, is great, joining is required. The joining position in this case, as shown in Figure 4, is position C at the top side, in the transport direction, of joint metal (46) with each moving transport auger (55a), (55b) and (55c), and said moving auger shaft (54) retracted into the shortest state. The position, where moving transport auger (54) is not inserted into said joint metal (46), makes movement of moving auger shaft (54) smooth.

[0027]

Moving transport auger (55a) is constituted with auger internal boss (57a), the inner diameter of which is hexagonal, the outer diameter of which is round, and that is a specified length, and that has a bolt insertion hole at the transport termination side; an auger external boss (57b) that is anchored to the outer diameter of auger internal boss (57a), that has a nearly semicircular shape

as shown in Figures 14 and 15 and a length of 1.5 times the pitch of auger flight (57c) of nearly the same shape, said auger flight (57c) of 1.5 times the pitch being anchored to the outer circumference of auger external boss (57b); and a reinforcing pin (57d) furnished on the transport termination side of auger flight (57c).

[0028]

The inner diameter of the transport termination of auger internal boss (57a) of said moving transport auger (55a) is inserted onto the external diameter of auxiliary shaft (53) of fixed auger shaft (52), and bolt (53b) is screwed into the screw hole of said auger internal boss (57a) in order to mount moving transport auger (55a). With regard to how bolt (53b) is inserted, as shown in Figure 4, the tip of bolt (53b) has a small diameter and the small diameter part is inserted into insertion hole (53c) furnished in said auxiliary shaft (53) to mount moving transport auger (55a). Although bolt (53b) is securely tightened, movement by moving auger shaft (54) toward the front or back is not affected.

[0029]

As for said auger internal boss (57a), as shown in Figure 4, in the inner diameter part of both the front and back ends, a specified length is formed in a round hole, a hexagonal hole (57e) is formed at the side of the round hole toward the transport termination part, and the round holes at both sides are formed with a larger diameter than the diagonal diameter of hexagonal hole (57e). The hexagonal hole (57e) section is inserted into and axially supported by moving auger shaft (54). Said moving transport auger (55b), as shown in Figures 11-13, is constituted with an auger internal boss (58a) of a specified length, and the inner diameter of which is hexagonal and the outer diameter of which is circular; an auger external boss (58b) of a length of 1.5 times the pitch, for example, of auger flight (57c), and with a nearly semicircular shape as shown in Figures 14 and 15, anchored to the external diameter of auger internal boss (58a), said auger flight (57c) of a length of 1.5 times the pitch being anchored to the outer circumference of auger external boss (58b); a stopper plate (58c) furnished toward the transport termination part of auger flight (57c); and a reinforcing pin (57d) furnished toward the transport termination part.

[0030]

As for said auger internal boss (58a), as shown in Figures 11 and 12, in the inner diameter part toward the front and back ends, a specified length is formed into a round hole, a hexagonal hole (58d) is formed to the side of the round hole toward the transport terminal part, and the round holes at both sides are formed with a larger diameter than the diagonal diameter of hexagonal hole (58d). Auger internal boss (58a) is mounted approximately in the center, in the front to back

direction, of auger external boss (58b) and auger flight (57c). Stopper plate (58c) is anchored to auger flight (57c) nearly perpendicular to the transport direction to make the transport of grain smooth.

[0031]

Said moving transport auger (55c) is constituted with an auger internal boss (59a), the internal diameter of which is hexagonal, the outer diameter of which is circular, that has a specified length and that has a bolt insertion screw hole toward the transport termination; an auger external boss (59b) that is anchored to the outer diameter of auger internal boss (59a), comprises a nearly semicircular shape as shown in Figures 14 and 15, and has a length of 1.5 times the pitch, for example, of auger flight (57c) of nearly the same shape; said auger flight (57c) of a length 1.5 times the pitch that is anchored to the outer circumference of auger external boss (59b); and a stopper plate (58c) furnished toward the transport termination part of auger flight (57c).

[0032]

The outer diameter at the transport termination of said moving auger shaft (54) is mounted by a bolt being inserted into, and axially supported by, the inner diameter of metal bearing (48b) furnished in moving transport tube (49), as well as being screwed into the screw hole in auger internal boss (59a) of moving transport auger (55c) with which said moving auger shaft (54) is equipped. Each of said moving transport augers (55a), (55b) and (55c) are constituted to retract overlapped with each other, and when retracted, the end faces of each of the adjacent auger internal bosses (57a), (58a) and (59b) touch each other, they are pressed and move in the retraction direction, and as for extension, the overlap of each of said auger flights (57c) is opened.

[0033]

As for said moving transport tube (49), as shown in Figure 21, termination metal (60a) is furnished as a way of separating the transport termination part of moving transport tube (49), moving auger shaft (54) is mounted on termination metal (60a), and moving transport augers (55a), (55b) and (55c) are inserted onto and axially supported on moving auger shaft (54). Said termination metal (60a) is mounted on said moving transport tube (49) with a bolt and nut or the like. Termination metal (60a) and moving auger shaft (54) can be unified or divisible, and assembly and disassembly are made easy in this way.

[0034]

As for said moving apparatus (50), as shown in Figure 1, a moving motor (61) is furnished at the base of an inverted L-shaped support plate (60) of circular cross section furnished at the

leading end of upper joint case (45c), and also metal bearing (62) is furnished at the leading end. Moving motor (61) and moving shaft (63) furnished with a helical screw (63a) on the outer circumference are formed integrally, and they are mounted on said support plate (60) with a bolt and nut. Moving shaft (63) is augerly inserted into moving metal (56b) furnished on the outer circumference of moving transport tube (49), and the leading end is supported by said metal bearing (62). As for moving metal (56b), as shown in Figures 22 and 23, support plates (64) and (64) are furnished at a specified spacing on the outer diameter of said moving transport tube (49), a support pipe (65) is furnished for support plates (64) and (64), a moving pin (66) is inserted into support pipe (65), and the upper part of moving pin (66) is mounted on support plate (64) with a cotter pin (67) or the like. The bottom part could also be inserted between the threads of said helical screw (63a) of said moving shaft (63), and movement by said moving transport tube (49) will be made smooth in this way.

[0035]

On the underside of said support shaft (60), as shown in Figure 1, a retraction-side sensor (68) and an extension-side sensor (69) of the on-off switch type, which sense the position in which moving transport tube (49) is retracted to the shortest length and the position in which it is extended to the greatest length due to contact with moving metal (56b) for moving apparatus (50), are furnished in moving transport tube (49). Also, to prevent direct contact of said moving metal (56b) with retraction-side sensor (68) and extension-side sensor (69) and to cushion impact, elastic members, for example, springs, and cushion members (70) and (71) made of a resin material or the like are furnished on the near side (lower part) to prevent damage. Said retraction-side sensor (68) and said extension-side sensor (69) are turned on and off via cushion members (70) and (71). The on-off state is input to a CPU furnished in operating unit (15), rotation starting and stopping by moving motor (61) is controlled by output from the CPU according to that input, and movement of said moving transport tube (49) is thereby controlled.

[0036]

Moving shaft (63) is driven to rotate forward or backward by driving of said moving motor (61) to rotate forward or backward, and moving metal (56b) causes moving transport tube (49) to move in telescoping fashion relative to fixed transport tube (47) along the outer circumference of fixed transport tube (47). Due to the movement of moving transport tube (49), moving transport augers (55a), (55b) and (55c) mounted inside can overlap and telescope.

[0037]

Said support plate (60) is constituted such that a part of the lower part, which is nearly circular, is covered with a moving cover (72) in which an opening (71a) is made. As shown in Figures 24 and 25, moving cover (72) is formed in an inverse U shape, and the base of moving cover (72) is mounted on a mounting plate (73) mounted on upper joint case (45c) with a bolt and nut or the like. Metal bearing (62), sensors (68) and (69), and cushion members (70) and (71) could also be furnished on the inside surface of moving cover (72), and moving shaft (63) could be mounted inside, and lower cost and lighter weight are achievable in this way.

[0038]

Upper joint case (74) is formed as shown in Figure 26. Moving motor (61), etc., could also be furnished mounted inside upper joint case (74), and improved product value, in terms of external appearance and lower cost, are achieved in this way. When said moving transport tube (49) is retracted to the shortest length and stowed inside combine (1), as shown in Figure 17 in plan view, the leading end (a) of moving transport tube (49) is positioned inboard of the leading end (b) of grass divider (9) of combine (1), which makes stowing and storage of combine (1) in a storage building easy.

[0039]

Said operating unit (15), as shown in Figure 18, is constituted furnished with an operating lever (75) that manually moves moving transport tube (49) of telescoping grain transport apparatus (3) up and down and right and left manually, an extending and retracting switch (76) with on and off directions to move said moving transport tube (49) automatically, a manual extending and retracting switch (77) with on and off directions to move said moving transport tube (49) manually, and a stop switch (78) with on and off directions to stop the movement of said moving transport tube (49).

[0040]

When said extending and retracting switch (76) is turned on, moving transport tube (49) of telescoping grain transport apparatus (3) is activated until it reaches the shortest retraction length or the greatest extension length where retraction-side sensor (68) and extension-side sensor (69) are activated. In order to stop its movement midway, potention [sic] metal is furnished to stop at any position.

[0041]

When said moving transport tube (49) moves automatically, if movement metal (56b) reaches a specified position on the near side of the mounting position of said retraction-side sensor (68) or said extension-side sensor (69), the travel speed of said moving transport tube (49) is controlled to slow to a prescribed speed by the CPU in operating unit (15).

Brief description of the figures

Figure 1 is an enlarged side view where a part of a telescoping grain transport apparatus is seen in cross section.

Figure 2 is an enlarged side view in which the telescoping grain transport apparatus is extended.

Figure 3 is an enlarged side view in which the telescoping grain transport apparatus is retracted.

Figure 4 is an enlarged side cross section of the part where the fixed transport tube and the moving transport tube are joined.

Figure 5 is an enlarged side cross section of the joint metal.

Figure 6 is an enlarged front view of the joint metal.

Figure 7 is an enlarged side oblique view of a part of the moving transport tube.

Figure 8 is an enlarged side oblique view of how the moving transport tube is joined.

Figure 9 is an enlarged side oblique view before the moving transport tube is joined.

Figure 10 is a function diagram of when the moving transport tube is joined.

Figure 11 is an enlarged side oblique view of a moving transport auger.

Figure 12 is an enlarged side view of a moving transport auger.

Figure 13 is an enlarged front view of a moving transport auger.

Figure 14 is an enlarged side view of the auger external boss.

Figure 15 is an enlarged front view of the auger external boss.

Figure 16 is a side view of the combine overall.

Figure 17 is a plan view of the combine overall.

Figure 18 is an enlarged oblique view from above of the operating unit of the combine.

Figure 19 is an enlarged side cross section of the thresher.

Figure 20 shows another application example, and is an enlarged side cross section of the joint metal.

Figure 21 shows another application example, and is an enlarged side view of the moving transport tube part.

Figure 22 shows another application example, and is an enlarged side view of the moving shaft part.

Figure 23 shows another application example, and is an enlarged front view of the moving shaft part.

Figure 24 shows another application example, and is an enlarged side cross section of the moving cover part.

Figure 25 shows another application example, and is a cross section at F-F in Figure 24.

Figure 26 shows another application example, and is an enlarged side oblique view of the upper joint case part.

Explanation of symbols

47 Fixed transport tube
48 Outer circumference
49 Moving transport tube
50 Moving apparatus
51 Transport auger
55b Moving transport auger
56b Moving metal
68 Retraction-side sensor
69 Extension-side sensor
70 Cushion member
71 Cushion member

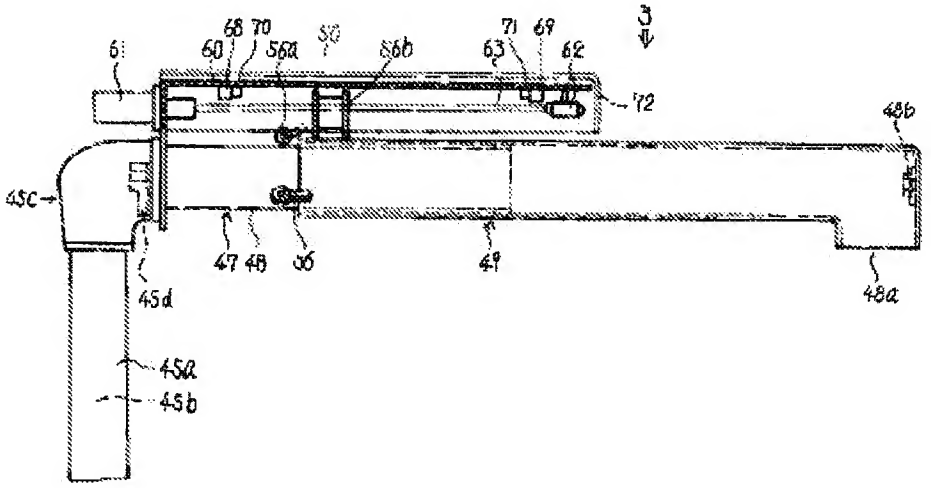


Figure 1

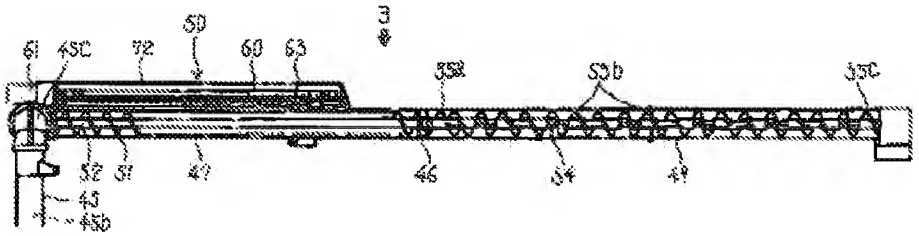
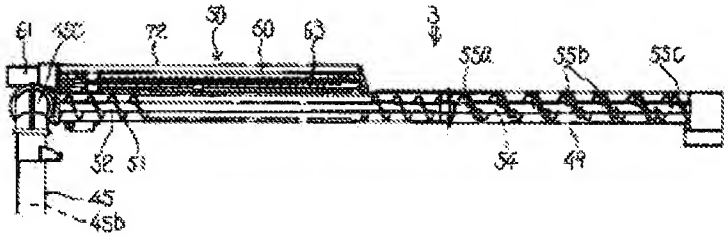


Figure 2



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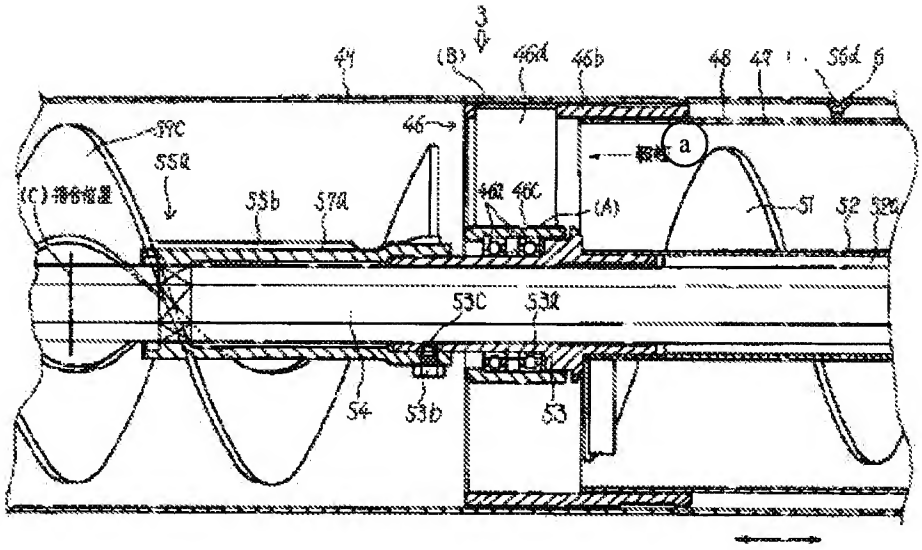
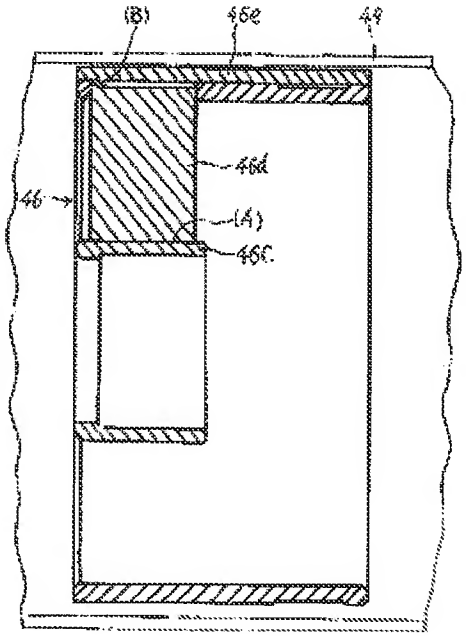


Figure 4

Key: a Grain flour

C Joining position



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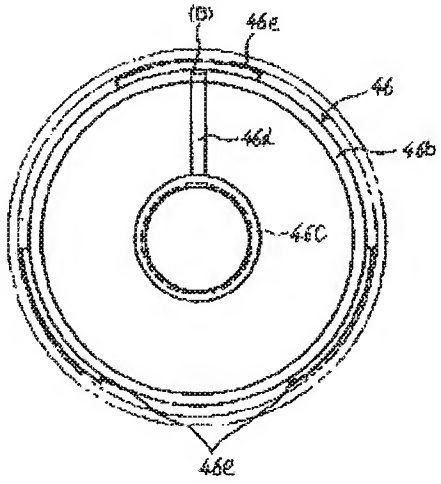

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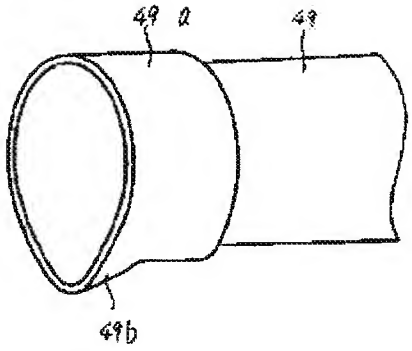

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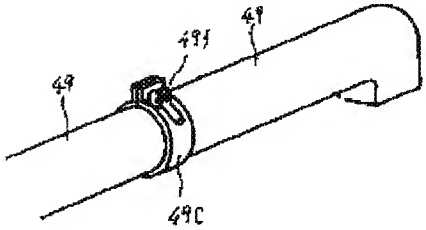

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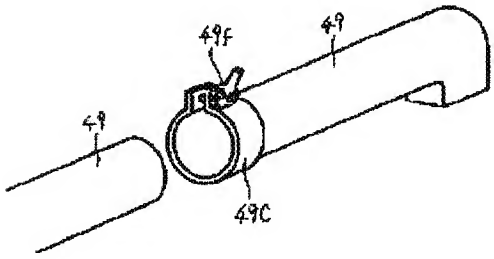

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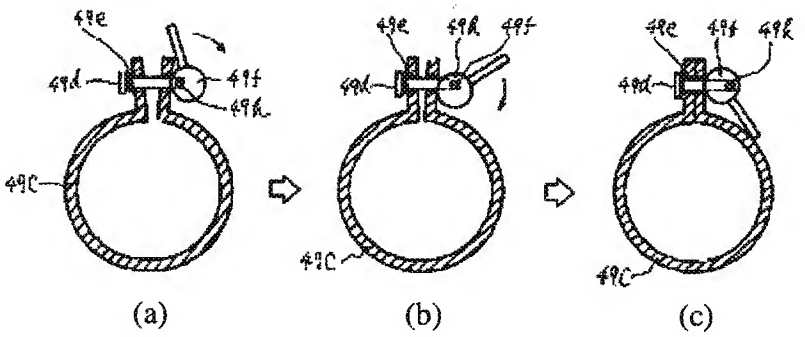

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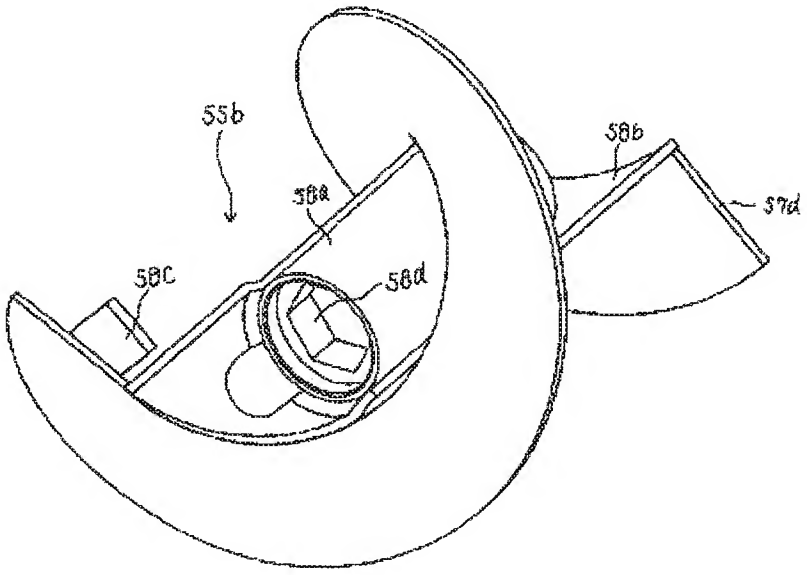

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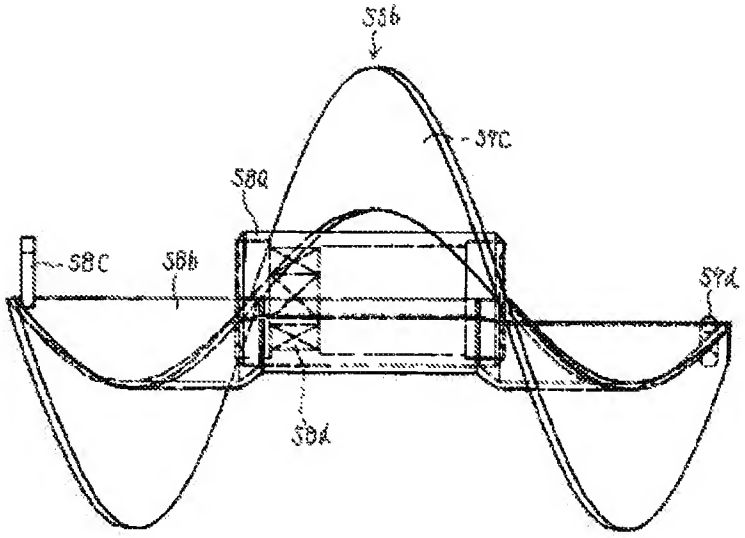

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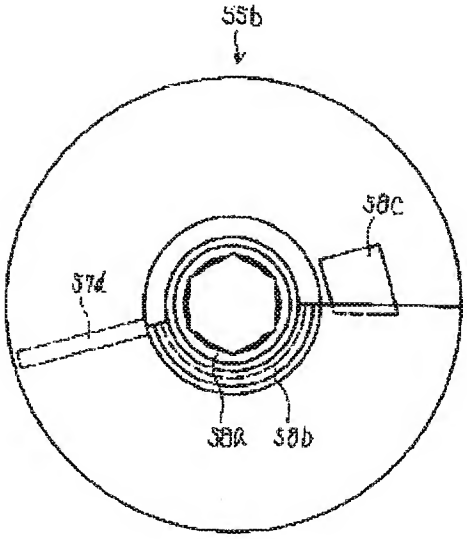

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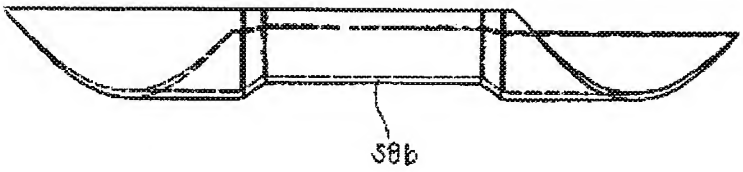

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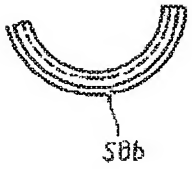

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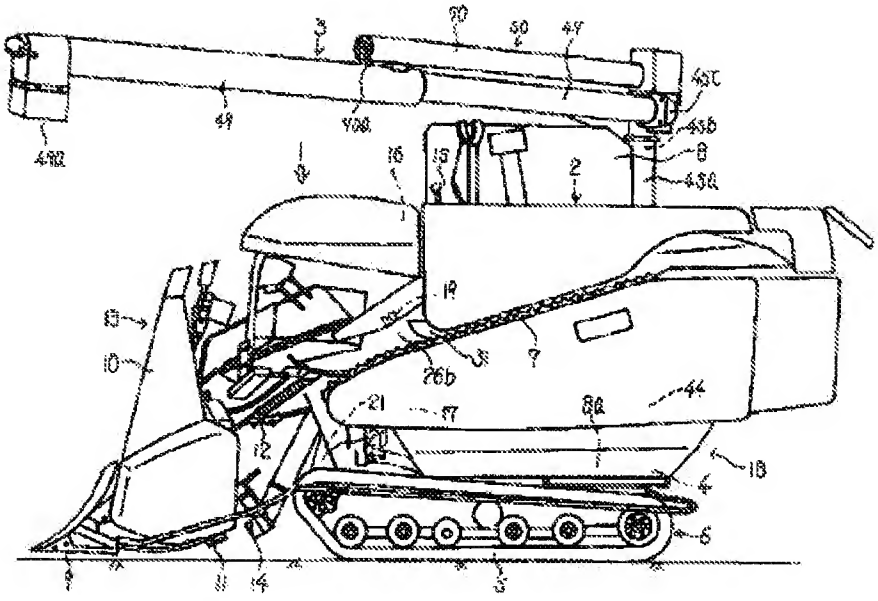

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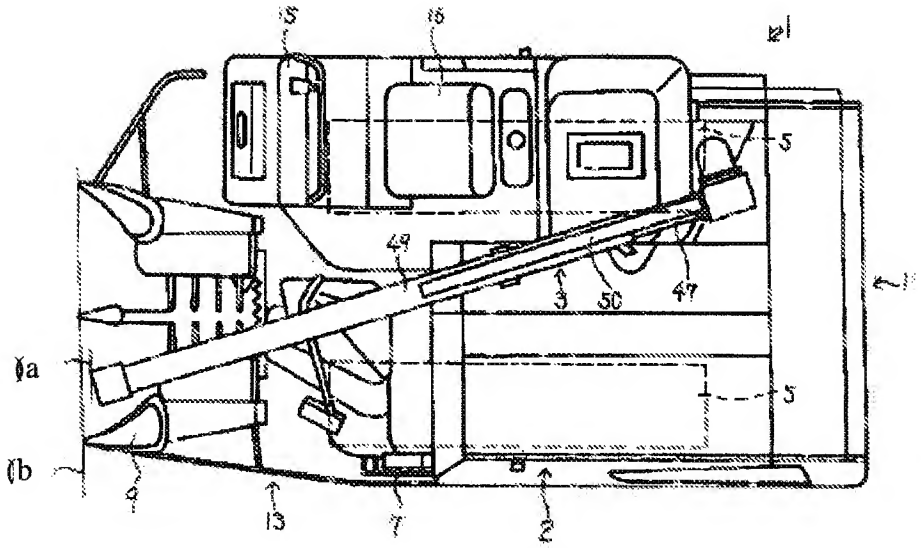

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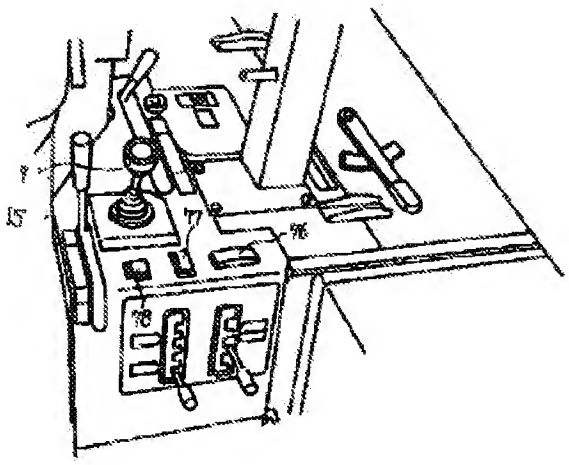

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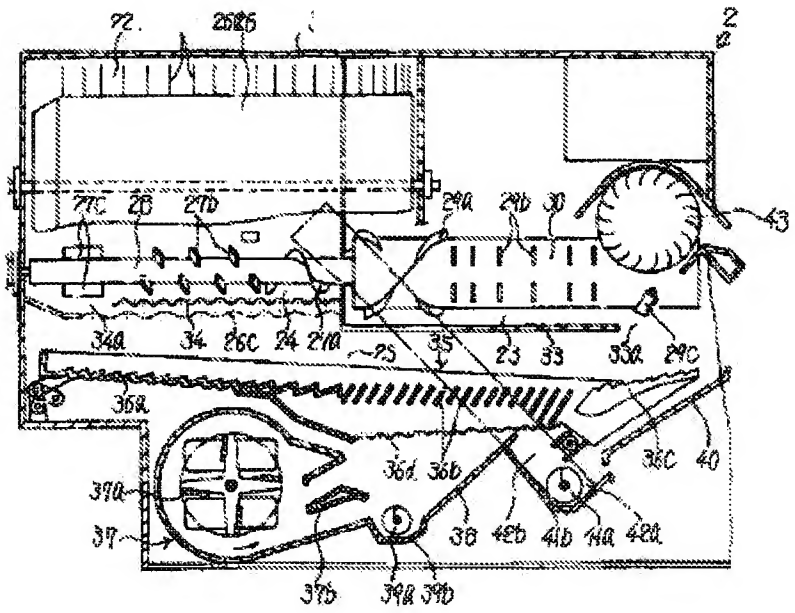

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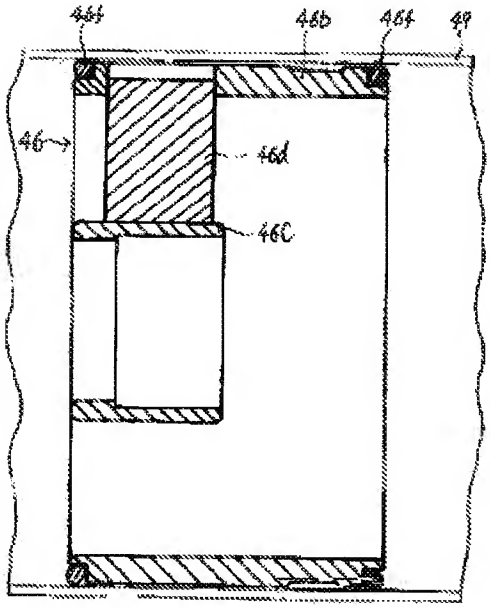

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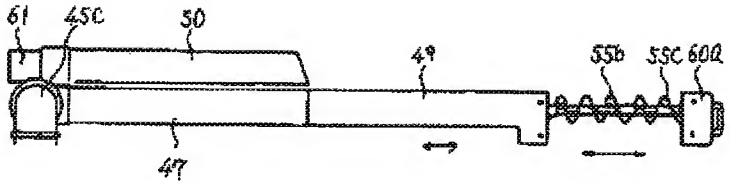

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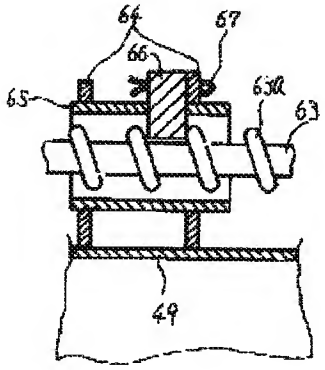

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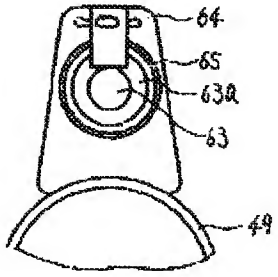

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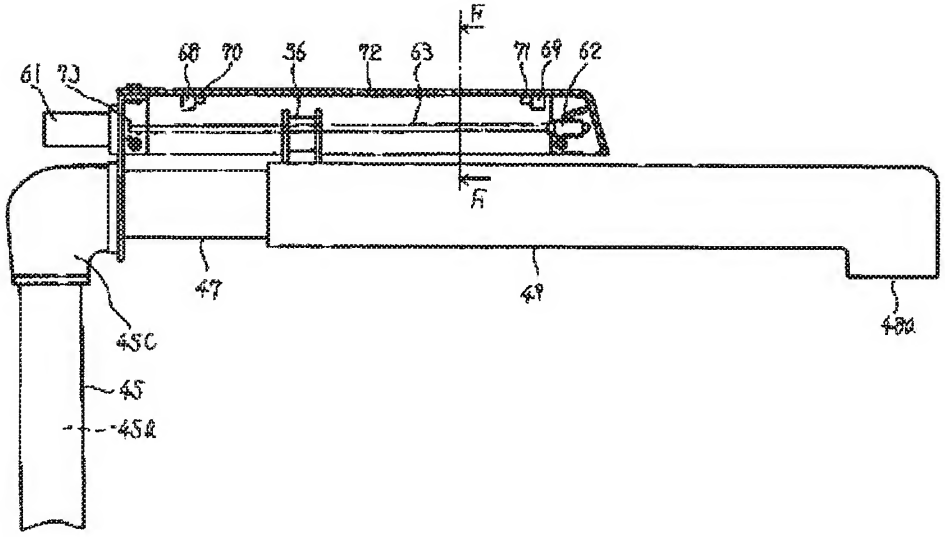

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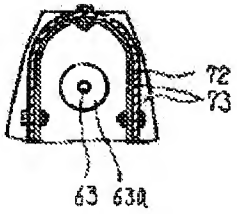

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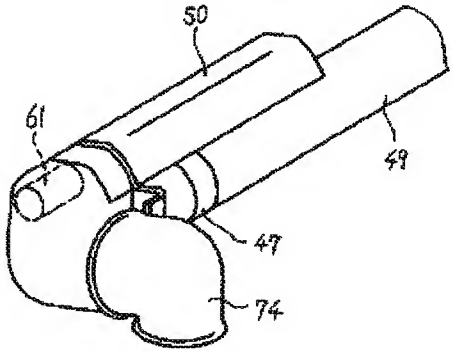

Figure 26